

1 CLAIMS

2 I claim:

3 1. A plasma reformer for dissociating water and hydrocarbon fuel in a preheated
4 gaseous form comprising:

5 a turbulent heating zone containing micro-porous articulated material with a first
6 impervious ceramic wall laterally bounding it;

7 a reaction chamber downstream from the turbulent heating zone, the reaction
8 chamber having emitter electrode means attached to the first impervious ceramic wall
9 laterally bounding it, an inner lateral wall containing collector electrode means, and an
10 electric circuit maintained between the emitter electrode means and the collector electrode
11 means;

12 an energy retaining zone containing micro-porous articulated material arrayed
13 downstream from the reaction chamber;

14 low thermal conductivity materials surrounding the energy retaining zone;

15 compression-expansion cushion material surrounding the low thermal conductivity
16 material;

17 a casing; and

18 means for introducing gaseous material in a flow into the turbulent heating zone and
19 for removing a reformat stream from the energy retaining zone.

20 2. A plasma reformer as set forth in Claim 1 wherein the emitter electrode means
21 have a multiplicity of thin needle-like extrusions.

22 3. A plasma reformer as set forth in Claim 2 wherein the needle-like extrusions
23 have diameters between 1 nanometer and 100 micrometers.

24 4. A plasma reformer as set forth in Claim 3 wherein the emitter and collector
25 electrode means are a metal selected from a group consisting of tungsten, zirconium,
26 titanium, molybdenum, and alloys thereof.

27 5. A plasma reformer as set forth in Claim 4 further comprising an ion neutralizing
28 filter surrounding the collector electrode in the reaction chamber.

1 6. A plasma reformer as set forth in Claim 5 further comprising a second ceramic
2 wall laterally surrounding the energy retaining zone and inside of the low thermal
3 conductivity material.

4 7. A plasma reformer as set forth in Claim 6 wherein the material in the turbulent
5 heating zone and the energy retaining zone have micro-porous structure layers selected from
6 a group consisting of alumina, silica, mullite, titanate, spinel, zirconia, or some combination
7 thereof.

8 8. A plasma reformer as set forth in Claim 7 wherein the low conductivity materials
9 are vacuum form fibers arrayed interior to fiber blankets, the vacuum form fibers having a
10 greater density and a higher percentage of higher melting point material than the fiber
11 blankets.

12 9. A plasma reformer as set forth in Claim 8 wherein the compression-expansion
13 cushion mat material is low thermal conductive material having a great capacity of
14 absorbing thermal compression-expansion, shocks and vibrations and having the ability of
15 sealing and protecting reformer material.

16 10. A plasma reformer as set forth in Claim 5 wherein the ion neutralizing filter
17 material is a semiconductor.

18 11. A plasma reformer as set forth in Claim 5 wherein the ion neutralizing filter
19 material is a ceramic alloy.

20 12. A plasma reformer as set forth in Claim 1 wherein there are plural electric
21 circuits connected to plural electricity sources.

22 13. A plasma reformer as set forth in Claim 1 wherein the means for introducing
23 gaseous material in a flow into the turbulent heating zone and for removing a reformat
24 stream from the energy retaining zone are double-walled tubes have an inner wall of a
25 ceramic material and an outer wall of stainless steel.

26 14. A process for reforming a preheated gaseous mixture of H₂O and hydrocarbon
27 fuels to produce hydrogen comprising:

28 further heating and mixing the mixture in a turbulent heating zone;

1 dissociating the H₂O through ionizing and dissociating the hydrocarbon fuel through
2 ionization and heat in a reaction chamber having emitter electrodes means in an outer wall,
3 central collector electrode means, electric circuits maintained between the emitter electrode
4 means and the collector electrode means causing copious numbers of high energy electron to
5 be emitted from the emitter electrode to interact with the hydrocarbon fuel thereby
6 dissociating the hydrocarbon fuel and forming low energy electrons that dissociate H₂O; and
7 further dissociating products leaving the reaction chamber in an energy retaining
8 zone.

9 15. A process as set forth in Claim 14 wherein the emitter electrodes have a
10 multiplicity of thin needle-like extrusions.

11 16. A process as set forth in Claim 15 wherein the needle-like extrusions have
12 diameters between 1 nanometer and 100 micrometers.

13 17. A process as set forth in Claim 16 wherein the material in the turbulent heating
14 zone and the energy retaining zone have micro-porous structure layers selected from a group
15 consisting of alumina, silica, mullite, titanate, spinel, zirconia, or some combination thereof.
16